Accelerator Mass Spectrometry dates and the antiquity of *Phaseolus* cultivation

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Samples of crop plant remains in early levels of archaeological sites are often so small that there is insufficient material to be dated by standard ^{14}C methods. Consequently, most of the published dates for such samples are based on associated organic remains such as charcoal or wood--but not directly on the remains of the actual crop plant samples. With increasing recognition of the extent to which seeds and other small objects may be displaced within archeological deposits, direct dates on small samples (one-half bean seed, for example) by Accelerator Mass Spectrometry (AMS) have become essential for reconstructing early agriculture and domestication.

Phaseolus remains are among the most elusive and rare of major crop plants in American archeological sites. Until introduction of the AMS dating method there has not been sufficient *Phaseolus* material to date by radiocarbon methods. Recently performed AMS dates on two bean samples, one from central Mexico, the other from the Central Andean highlands, both with AMS dates about 2400-2500 years before present time (yBP) (Table 1) offer reason to believe that published ages of 6000-8000 years before present time in these regions will be revised when a current project for dating of many additional samples has been completed.

Table 1
REVISED CARBON-14 DATES FOR PREHISTORIC *PHASEOLUS VULGARIS*

	C-14 DATES yBP	
SAMPLE	AMS DATE[1]	INDIRECT DATE
TEHUACAN BEAN, 1 POD VALVE	2,285±60	6975±200[2]
GUITARRERO CAVE, 1-SEED,	2,430±60	7680±280[3]

[1]A.J.T. Jull, Accelerator Facility, University of Arizona
[2]Kaplan 1967
[3]Kaplan, Lynch, and Smith 1973

The earliest date for the appearance of *P. vulgaris* in El Riego Cave, in the Tehuacan Valley of Mexico is that of a single pod fragment, AMS date 2285±60 (Table 1), previously reported to be 5000-7000 years old (Kaplan 1967) although questioned (Kaplan 1981). This AMS date is about the same as that for common beans

from the United States Southwest which were approximated by older dating methods (Kaplan 1956) and reaffirmed more recently: Common beans recovered from early levels of Bat Cave and Tularosa Cave, both in New Mexico, are 2140±110 and 2470±250 respectively (Wills 1988)--about the same as dates for the Tehuacan Valley.

In the Central Andean Highlands (Guitarrero Cave) of Peru, common beans were reported to be as old as 7680±280 yBP on the basis of indirect ^{14}C dates (Kaplan, et al 1973). Evidence from the current AMS dating project using samples of the seeds themselves do not support so early a date. When the AMS date is adjusted for changes in atmospheric ^{14}C by means of tree ring calibration beans are shown to be present in the Central Andean highlands by about 3000 yBP.

Two samples of *P. lunatus* from South America (Guitarrero Cave, Central Andean Highlands of Peru) have been AMS dated at 3495±50 yBP and 3325±55 yBP.

The common and lima bean remains, directly dated and reported here from Mexico and Peru are indistinguishable from pod and seed structures of contemporary cultivated beans. They reveal no wild traits and bear no more morphological resemblance to wild *P. vulgaris* than do contemporary cultivars. They are the product of long selection by early Indian growers. With further archaeological exploration and recovery, much older specimens will probably be found, but for now, the published record is being corrected.

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